

# HANDLING SOLUTIONS FOR ELECTRONIC WASTE (E - WASTE) IN INDONESIA

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## Abstract

Any changes always take effect to the environment either positive or negative, it is no exception developments in technology. In addition to bringing benefits to the human development, technology has always had a negative impact, actually thrash or waste from obsolete technology as the results of the process productions or side product. The mobile phones waste is one of the electronic waste that need to be awareness. Electronic waste processing in particular mobile phones as one of the new problems in the waste management, and it will be an ice mountain problem for developing countries because generally they have limited technology, insufficiency of financial and lack of human resources in the management of electronic waste that electronic trash left to accumulate for granted. Indonesia as a developing country need to strengthening regulatory, economic support and technology transfer of electronic waste management from developed countries to suppress pollution caused by electronic waste disposal carelessly.

**Keywords:** electronic waste, cell phones, regulation.

## Introduction

The development of electronic industries today resulted in many electrical and electronic equipment that are mushrooming and make the price more affordable so it can be affordable by all customers, not only from developed country but also from developing countries. In the era of globalization and today's modern electronic devices based on the use of high technology in the field of information and communication becoming commonplace, the use of communication devices such as mobile phones are not limited to only needs but has become a way of life. Changes in the function of the communication device into a fashion is then deliver its own problems including the electronic waste generation , as a result of frequent mobile phone users replace them with new ones, although still fit for use (Hester & Harrison, 2009).

Globally there are now 5 billion mobile phones registered with the GSM (Global System for Mobile Communication) and soon will be replaced by new technologies. Changes of 3G GSM networks to 4G LTE (Long Term Evolution) is the evolution of information technology is very impressive , the data transfer speed increased almost 10 times, so that communication will be faster and more fun . However, it brings a significant impact to the waste problem because the hardware used in mobile phones for GSM 3G with 4G LTE slightly different so that there should be a replacement gadget if you want to enjoy the 4G technology to the fullest (Sauter, 2014).

Table 1. Statistics use mobile devices and the Internet.

| Statistics                          | Population Percentage |
|-------------------------------------|-----------------------|
| Internet users and mobile phone age | 34 %                  |
| Internet users                      | 66 %                  |
| Internet growth                     | 18 % per year         |
| The growth of mobile phone users    | 140 %                 |

Source: The World Bank, 2012 accessed from [www.e27o.com](http://www.e27o.com)

The table above provides an illustration of how the rapid development of mobile phone usage today, reaching 140 %. This means that in one year sales growth and the use of mobile phones by the public increased by almost 1.5 times. This suggests to us not forget the impact that would occur if the world will be filled with mobile phone garbage.

## Methods

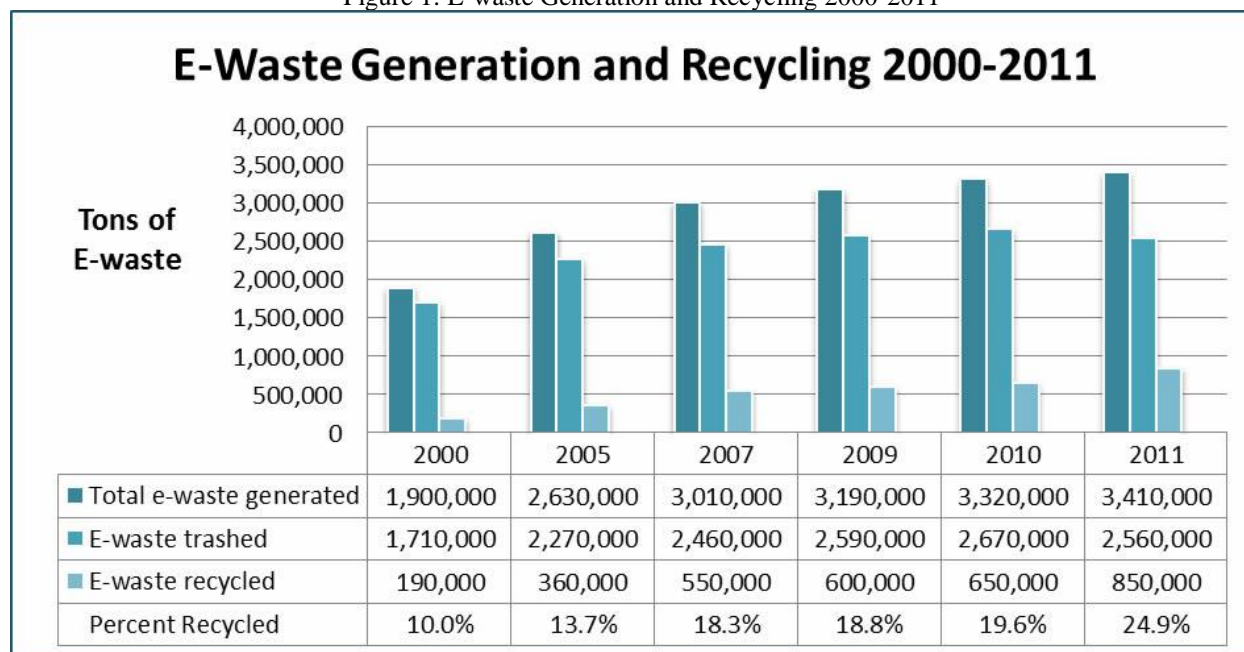
This study was an article review, the data was collected from 1993 to 2015 and analyzed to show the problem with electronic waste and the impact for earth. The aim of this study was to fill the gap in electronic waste reduction between developed and developing countries.

## Results and Discussion

### Problem in Developing Countries

Developing countries have always been associated with all the underdevelopment and poverty. The world organization (UN) through the WTO describe briefly the developing countries and dividing by the average income of the country's population. The main problem in developing countries is the high cost of technology and lack of human resources to manage hazardous and toxic materials and wastes. However some and many cases, developing countries instead become an electronics waste dumping from developed countries because they believe could have goods from developed countries although slightly damaged and will try as much as possible be repaired to be used, but the fact is a lot of unused stuff which can only become garbage rather than electronic goods which can be recycled. Indonesia as the country with the largest population to 4 in the world (252 million people) after China, India, and USA (Worldometers, 2014) will became one of the "best market" for mobile phone manufacturers and it is very potential in contributing to the amount of electronic waste.

Figure 1: E-waste Generation and Recycling 2000-2011

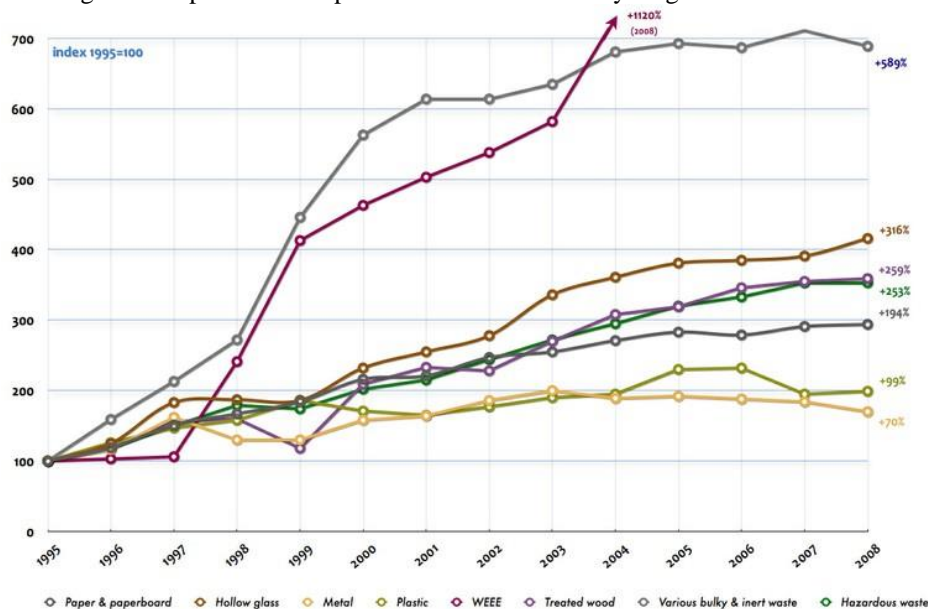


Source: EPA, 2011.

From the year of 2000 and 2010 less than 20% e-waste has been recycled, 80% was gone in world that we can't trace it. In 2011 it has been increasing in recycling e-waste it's about 25%, so we have 75% more waste to recycled. Started in 2000 the total number of e-waste as much as 1.9 million tons and increased to 3.4 million tons in 2011.

Asia Pacific region is the most populous parts of the world where more than half the world's mega cities are here. The economic development of the Asian - Pacific population much centered on the cities. The problems of electronic waste becomes more complicated when look at that infrastructure city built mostly unorganized from the start. Development of the city just follow urbanization every year that only adds the burden of population growth and congestion for major cities. Urbanized societies are often talkative buying electronic goods even they may not need instead of using technology, they buy more technology for prestige and style, not to support their productivity. According to predictions (Lewis, 2014) in livescience.com in 2017 there will be piles of electronic waste as much as 65 million metric tons per year which is equivalent to 11 times the height of the Giza pyramid, including the electronic waste is a mobile phone.

Figure 2: Separate municipal waste collection in recycling centres: 1995-2008



Cites from <http://www.eea.europa.eu/soer/countries/lu/waste-state-and-impacts-luxembourg>

There is trends in use of electronic equipment, the above picture shows the various types of waste both households and industries. Electronic trash is widely recognized as WEEE (waste electronic and electrical equipment) had a significant increase in recent years that approximately 1120 % in less than 10 years far above metal and plastic waste so that it can become a problem for every human being, especially in developing countries.

### Electronic Waste

Electronic waste began to be the world's attention since the late 20th century because at the time of the industrial revolution that continues to this day to the era of digitalization. With the vigorous creation and technological innovation, old stuff that has been aged will also depleted of its life, providing new challenges for managing solid waste in the form of electronic waste. There is something unique and interesting of electronic waste because it turns out there are many precious metals that are in the electronics components so that electronic waste has more value than other solid waste such as household waste. The study found that electronic waste mobile phones have precious metals that can be obtained from the processing, including bronze, silver, and gold (Chancerel, EM Meskers, Hageluen, & S. Rotter, 2009).

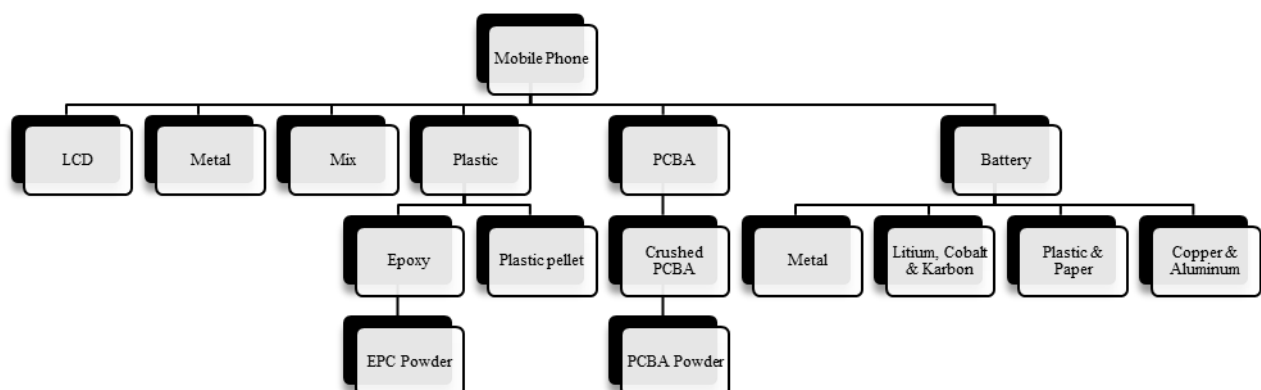


Figure 2: The components in mobile phones (source: <http://www.zerowasteq.com/>)

Mobile phone consists of many components, built with compact wrapped in an attractive plastic packaging. Some components of the mobile phone are: PCB plate or printed circuit board that used to plant mobile phone major components (circuit, CPU, internal memory, etc.). A hard plastic wrap, made of metal to strengthen and shape the framework, LCD display and a few other components to add features and functionality such as buttons and keyboard, and a battery for storing power.

The development of the mobile phone display is inseparable from the development of television. CRT tube television (cathode ray tube) especially is one of the main contributors to both electronic waste volume and hazard. The main substances that are very dangerous to humans is the main raw material TV tube it is lead. While the LCD TV (liquid crystal display) that have more modern technology mainly discarded because the price of repair after damage is more expensive than buying a new one, a lot of its components containing mercury. Television is the forerunner of the mobile phone display, modified many way such that it can be portable and taken anywhere. Currently, the mobile phone display change more wide and sophisticated because it has been adopting touch-screen technology. Substances its contain such as lead (Pb) and mercury (Hg) is a carcinogenic that can cause cancer to humans who are exposed in the long term (US EPA, 2000).

One of the raw material cell phones are dangerous to human health is a BPA (bhispenol A) as the main ingredient for manufacturing plastic to form models of mobile phones and mercury as the main raw material of LCD (the display). The use of BPA in the manufacture of plastic materials for food and beverage containers today began avoided, but still widely used in the manufacture of plastics for other purposes that are not directly in contact with food into the human body. According to various studies BPA is a compound which is potentially can disrupt hormone work and normal function of the human body that can cause negative effects on health when the reproductive period , the development and believed could also cause adverse effects on human behavior ([www.riderdigest.co.id/](http://www.riderdigest.co.id/) ).

Some of the ways that can be used to reduce waste of electronic waste in the form of plastics, especially PVC, among others, are (Tucker, 2002):

1. Reuse of plastic waste without making any changes (if possible).
2. Recycle waste without changing the structure / agent / waste compound.
3. Recycle chemically, where the chemicals can be used again to create new materials.
4. Recycle chemically, but the recycled compound used for other needs.
5. In the recycling to be converted into energy, i.e. heat energy.

In addition to the above method more modern way in India (Jayapradha, 2015) being developed various techniques to reduce the dangers of electronic waste, among others:

1. Hydrometallurgy, which uses chemicals (reagents) for separating certain hazardous substances from electronic waste.
2. Pyrometallurgy, using heat to reduce hazardous substances in electronic waste and convert it back into energy.
3. Bioleaching, which uses activated carbon to absorb high-value elements of the electronic waste that can be reused.
4. Electrometallurgy, using electricity to separate the precious metals from electronic waste.

### **Strengthening Regulations**

The last few years become a trend in which developed countries selling used electronic goods in developing countries for reuse by people of developing countries because it is considered more economical, but quite a few are ultimately just be a pile of garbage, mobile phones are no exception. Almost every day can be seen on television and in newspapers and magazines, there are new models launched by mobile phone manufacturers so that a potential accumulation of garbage becomes higher when consumers are deceived by the ads. In addition to producing some of the precious metals, it is also dangerous electronic waste. The hazard not only because it can lead to imbalance and cause nuisance to the environment due to metals contained in them, but also have adverse effects on human health either directly or indirectly. One reason is the lack of regulation (United Nations University, 2014).

Growing regional autonomy policy in Indonesia is able to spearhead the implementing regulation of the processing of electronic waste, it is very effective because the local government has the authority legally within its jurisdiction. Implementation of strict restrictions on electronic waste as hazardous material has been done in the United States during the period 2003-2011 which includes 25 states. Not easy to apply strict rules on the company and the area where it operates to be responsible electronic waste processing their products. After rolling rule turns out to foster a new industries that is local industry and sewage treatment is a business opportunity that has a very good chance.

Rules are feared will impact on corporate earnings and the reduction in the area has not been proven so that we too can and should not hesitate to apply the rules as restrictive as possible (Leigh, Choi, & Z. Hoelzel, 2012).

Electronic waste can't be disposed of carelessly like household waste or solid waste through the streets of a simple way to be dumped in land that has been provided, but must be treated and processed in advance to be safe when discharged into the environment. Electronic waste is classified as hazardous and toxic waste because containing so many hazardous and toxic materials. General conditions in the disposal and management of waste, including hazardous and toxic waste regulated in Law No. 32 of 2009 on the Protection and Management of the Environment (UUPPLH), updating UUPPLH namely Law No. 23 of 1997 on environmental management. In particular, the rules regarding the management of hazardous and toxic materials arranged and translated through government regulation (PP) No. 74 in 2001 and PP 85 of 1999 on the management of hazardous and toxic waste, while in the technical management of hazardous and toxic materials and wastes regulated by Decree of the Head of Environmental Control Board.

Less than next 2 (two) years, precisely at the beginning of January 2017 our Government will impose a local content rule for every mobile phone product available in Indonesia. Application of DCL (local content) of 40 % is applied to the government for a cell phone company that distribute their products in Indonesia can be seen as a good thing and very helpful . Besides being able to develop the raw materials industry in the country, this regulation can also help the government in overseeing any material which is used to make a cell phone so that the government can determine the proper waste management through the identification of raw materials when the mobile phone has not been used and become litter (Jabarnews, 2015 ).

On the level of concepts and regulations regarding the management of hazardous and toxic materials and wastes has been made in such a way idealistic , but still need consistency and firmness apparatus on the field implementation stage. Many have likened the state of law in Indonesia is like a toothless tiger, scary frightening appearance but brittle bites. Not only in the field of environmental law but also nearly all fronts and the legal field. Such conditions may indirectly harm the environment because of the absence of protection is strictly one of which is through the enforcement of regulations and laws that environmental pollution will remain and continue to occur without any real effort of law enforcement officers.

### Human Resource Development

God has said in the Quran. Ar Rahman ( ayah 33 ) :

يَمْعَشَرَ الْجِنَّ وَالْإِنْسَ إِنِ اسْتَطَعْتُمْ أَنْ تَنْفُذُوا مِنْ أَقْطَارِ السَّمَوَاتِ  
وَالْأَرْضِ فَانْفُذُوا لَا تَنْفُذُونَ إِلَّا بِسُلْطَانٍ ﴿٣٣﴾

33. O assembly of jinns and men! if You have power to pass beyond the zones of the heavens and the earth, Then pass (them)! but You will never be Able to pass them, except with authority (from Allâh)!

From the above verse clearly express that we can do anything if it has power. Currently analogous strength as a technology that helps us to realize all the dreams including travelling through the sky and on earth. It is undeniable that the problems of litter and waste management we need the technology to process and neutralize harmful substances in electronic waste that is safe for the environment and no impact on human health.

Various methods are used to treat waste should certainly be environmentally friendly and inexpensive so that it can be applied in Indonesia. Moreover the operation and maintenance of waste treatment equipment must be easy to do considering the existing human resources quality is still far from developed countries. Mobile phone manufacturers who set up factories in Indonesia must allocate funds for education and training for workers so that manufacturers have the ability to perform "self producer responsibility" namely the obligation producers to manage their used e-waste products (Mayers , Lifset, Bodenhoefer, & Wassenhove, 2012).

Intensive assistance needs to be done on the state sellers sewage treatment equipment to the workers actually master the device, something like this could have tried to imitate the process of buying and selling Shukoi aircraft some time

ago. When Russia sold some aircraft to Indonesia, they also send the pilots from Russian air force pilots to trained Indonesian pilots until they able to operate it, and they also provide Shukoi's mechanic to train Indonesian mechanics. It is a form of responsibility of the seller and one part of the excellent service provided by the Russian government for the customer the Indonesian government. If this can also be applied to matters of the sale and purchase of hazardous waste treatment equipment then we will also get the transfer of technology and not just be a mere consumer. If the developing countries has been carried out, followed by an increase in education and human resources development in the form of seeing, imitating, and adding the process of toxic materials and hazardous waste can be done well.

### Financial Support

Referring to the Kyoto Protocol (1999) concerning the reduction of carbon emissions and the principle of justice for all citizens of the world where the supply of carbon, are required to pay the State which has forests for maintaining their forests to reduce carbon emissions, the same thing can also be done in the context of reducing hazardous waste pollution in developing countries is by way of developed countries to provide assistance in the form of grants or soft loans for developing countries to be able to buy electronic equipment waste processing and / or conduct research in order to find effective and efficient equipment in order to reduce electronic waste ([www.unfccc.int](http://www.unfccc.int)).

Human resources skills for operating waste treatment plant needs to be supported with financial strength, because although we have a complete regulation then have qualified human resources without any financial support then all will be useless and it will open up opportunities Other countries utilize our human resources. Many facts prove that the funding is one of the essential elements although not the main one in the success of a business. Human resources as well as qualified financial support an absolute requirement in developing a wastewater treatment system that has been there (Drucker, 1993).

### Conclusion

The problem of electronic waste is a problem together. Cooperation between nations in the world needed to tackle the problem of electronic waste, it is associated with second-hand goods trade flows between countries. Strong regulatory support, especially from the local government, sharing technology for improving the quality of human resources and financial assistance from developed countries become an inevitable necessity for the sake of the environment. Three things must be done together comprehensively and full of commitment. It's difficult to get the maximum results if only applied to one side only but ignore other factors.

### References

- 25 Handphone Recycling. (2011, June 4). Retrieved from <http://www.zerowastesg.com/2011/06/04/photos-from-recycling-week-2011/25-handphone-recycling>.
- Anonym. (2014, March 5). With 140% mobile penetration, Malaysia has 10M smartphone users. Retrieved from <http://e27.co/140-mobile-penetration-malaysia-10m-smartphone-users>.
- Chancerel, P., E. M. Meskers, C., Hageluen, C., & S. Rotter, V. (2009). Assessment of Precious Metal Flows During Preprocessing of Waste Electrical and Elektronik Equipment. *Journal of Industrial Ecology*, 13(5), 791–810.
- Drucker, P. F. (1993). *Management: Tasks, Responsibilities, Practices* (Reprint edition). New York, NY: HarperBusiness.
- Hester, R. F., & Harrison, R. M. (2009). *Issues In Environmental Science and Technology*. Royal Society of Chemistry.
- Jayapradha, A. (2015). Scenario of E-waste in India and applicatiob of new recycling approaches for E-waste management. *Journal of Chemical and Pharmaceutical Research*, 7(3), 232–238.
- Leigh, N. G., Choi, T., & Z. Hoelzel, N. (2012). New Insights into Electronic Waste Recycling in Metropolitan Areas. *Journal of Industrial Ecology*, 16(6), 940–950.
- Lewis, T. (2014). World's E-Waste to Grow 33% by 2017, Says Global Report. Retrieved May 25, 2015, from <http://www.livescience.com/41967-world-e-waste-to-grow-33-percent-2017.html>

- Mayers, K., Lifset, R., Bodenhofer, K., & Wassenhove, L. N. V. (2012). Implementing Individual Producer Responsibility for Waste Electrical and Electronic Equipment Through Improved Financing. *Journal of Industrial Ecology*, 17(2), 186–198.
- Mewaspadai Bahaya BPA di Kemasan Plastik. (n.d.). Retrieved June 12, 2015, from <http://www.readersdigest.co.id/sehat/info.medis/mewaspadai.bahaya.bpa.di.kemasan.plastik/005/001/312>
- Ministry of Sustainable Development and Infrastructure - Environment Agency. (2010). *Municipal waste: high generation but also high recovery rate*. Retrieved from <http://www.eea.europa.eu/soer/countries/lu/waste-state-and-impacts-luxembourg>.
- Pemerintah Tetap Terapkan Aturan Produk HP 40% TKDN. (2015). Retrieved from <http://jabarnews.com/?p=375>.
- Population by Country (2014) - Worldometers. (2014). Retrieved May 25, 2015, from <http://www.worldometers.info/world-population/population-by-country>.
- Rich and Poor Nations Can Link up to Recycle E-waste - United Nations University. (2014). Retrieved May 25, 2015, from <http://unu.edu/publications/articles/rich-and-poor-nations-can-link-up-to-recycle-e-waste.html>.
- Sauter, M. (2014). *From GSM to LTE-advanced : an introduction to mobile networks and mobile broadband* (2nd ed.). John Willey & Sons.
- Tucker, A. (2002). *Plastics Waste Feedstock Recycling, Chemical Recycling and Incineration* (Vol. 13). Rapra Technology, Ltd.
- Undang-Undang No. 32 Tahun 2009 tentang Perlindungan dan Pengelolaan Lingkungan Hidup.
- UNHCC. (2005). Kyoto Protocol To The United Nations Framework Convention On Climate Change. Retrieved from <http://unfccc.int/resource/docs/convkp/kpeng.html>
- US EPA, O. (2013) Mercury Compounds | Technology Transfer Network Air Toxics Web site | US EPA. Retrieved May 28, 2015, from <http://www.epa.gov/ttn/atw/hlthef/mercury.html>
- (2015) 2011 Facts and Figures Fact Sheet. Retrieved June 20, 2015, from <http://www.epa.gov/solidwaste/nonhaz/municipal/msw99.html>.